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**CHALLENGES FOR THE SUSTAINABLE
DEVELOPMENT OF ROAD SYSTEMS**

**MOVING TOWARDS NETWORK OPERATIONS
IN SWEDEN**

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ABSTRACT

National road authorities are responsible for network operations that include aspects such as safety, efficiency, sustainability, maintenance, traffic management and information. This is a complex task and involves many perspectives.

This paper deals mainly with experience in integrating network operations into the regular governance system at the Swedish Road Administration. Recent years have seen a change in the environment in which national road authorities are operating. Traffic volumes continue to grow at rates that cannot be accommodated via increases in capacity through construction, which worsens congestion and makes journey times both unpredictable and unreliable. Being able to increase the efficiency of the transport system becomes a key issue when it has been found that extending the capacity of the infrastructure does not solve the problem. Other methods are needed and ITS will play an important role.

The paper also provides a few examples of the move towards network operations at the Swedish Road Administration using ITS as a tool.

1. INTRODUCTION

The design and functioning of the road transport system is intended to ensure socio-economically efficient and sustainable transportation. Individuals and the business community in Sweden all depend on safe, efficient, and environmentally-sound transports.

The implementation of ITS is one of several measures that contribute to achieving the goals in transport policy. Sweden currently has a high level of knowledge in the field of IT and telecommunications, road safety and the environment coupled with broad expertise in the automotive industry. The Swedish Road Administration (SRA) is of the opinion that the combination of all this expertise could make ITS a cost-effective complement to the physical upgrading of the road transport system. In the context of network operations it is important to emphasise the generation of strong incentives and driving forces to ensure that the will to cooperate among the parties concerned results in a joint commitment to develop, implement and use ITS as a powerful tool.

The Swedish Parliament and Government support a greater use of new, creative and effective solutions like ITS to solve transport problems.

The SRA considers that the key to a successful implementation of new transport systems and services is to initiate and support large-scale field trials by users all over the country. This has been done in a number of areas and the results have proven very positive.

2. INTERNATIONAL EXPERIENCE IN THE USE OF ITS

There are great expectations for ITS (Intelligent Transport Systems and Services) at the international level. In recent years public stakeholders along with the IT, automotive and transport industries have made significant advances in research and development in the field. Europe needs an integrated transport system based on a fast, reliable and safe infrastructure that meets the requirements of both the business community and citizens. There is a wide variation in how ITS is being implemented in Europe, and there are ongoing efforts in the EU to draw up a strategy to ensure that its implementation is successful.

The EU has in recent years highlighted and focused on road safety. In the (15) EU member states about 45 000 people are killed and 1.7 million injured on roads every year. The EU has, as has Sweden, chosen a quantifiable goal and aims to halve the number of road fatalities by 2010. The Commission has therefore made a concerted effort in the field of road safety issues within the Union. This resulted in the “eSafety initiative” that among other things led to a Commission notification where ITS was put forward as a measure to increase road safety.

International experiences show that the benefits of ITS increase as more people use them and when services are integrated. Interoperability, standards and system architecture are important components. This is supported by cooperation between public authorities, the private sector and users. Several international sources in Japan, the US and Europe report that ITS applications have a significant potential to reduce accidents, shorten travel times in urban areas, assist travellers and business, and reduce the negative impact on the environment.

3. THE ROLE OF THE SRA IS CHANGING

In recent years the environment in which national road authorities operate has been changing. Traffic volumes continue to grow at rates that cannot be accommodated via increases in capacity through construction, which worsens congestion and makes journey times both unpredictable and unreliable. Construction costs are increasing and being examined more critically as the current financial situation entails greater budget constrictions. Furthermore, as a result of growing environmental awareness and the expectation that national road authorities should deal with incidents and external spatial planning, they are encountering new restrictions on their work.

Road authorities have often initially introduced ITS to solve individual problems such as road safety or congestion black-spots. However it has become more and more clear that the problems are not just local, but need a network approach. In addition, road authorities are increasingly affected by others who produce roadside and in-vehicle equipment, including the automotive industry which has developed ITS and safety systems in cars, etc, and might want to take the lead in ITS applications. Finally, more and more user-oriented services are being provided by private industry, possibly with objectives in conflict with the responsibilities of national road authorities.

These developments are taking place in the various European countries, as well as in other developed countries, at different speeds depending on local circumstances, policy, organisation, level of implementation and expertise.

In this situation national road authorities have to adapt in order to continue fulfilling their major task of maintaining and improving the traffic flow and road safety. Although maintaining the road quality and building new roads is still important this is no longer enough as the road authorities must ensure that they first make the best use of the existing infrastructure. As a result, their role is changing and becoming more complex as the focus is not only on the infrastructure, but also on the road user and includes network management and operations. This is the process that has been called the 'Major Shift' or the move towards network operations.

4. FIRST STEP TOWARDS NETWORK OPERATIONS IN SWEDEN

In Sweden the move towards network operations started with the SRA realising its role in creating good prerequisites for transports and journeys. This was formulated in the following vision:

"We make the good journey possible. Focusing on people, the Swedish Road Administration creates opportunities for efficient, safe and environmentally-sound transport for individuals and the business community."

This vision, in combination with national transport policy, has pointed out different groups in society that have different needs as regards transportation and services. In order to deal with this, the SRA introduced a customer and process-oriented organisation in 2003.

In general, it can be said that private companies need information for transport planning as well as real-time information while travelling. Via various types of transport management centres, this information steers logistics chains for goods distribution. Delivery quality (time, cost) is the most important factor in the private sector.

If an infrastructure is in place, both physically and digitally, and the transport industry functions, the primary need for road carriers is efficient transport possibilities.

Private individuals want different types of traffic information, both ahead of and during a journey. In rural areas this concerns information about road conditions and bearing capacity, while in urban areas information is mainly required about congestion and disruptions. Gainfully employed persons are interested in journeys that are safe, with a high degree of reliability and that offer fast transport between points A and B.

The SRA Strategic Plan for the period 2005-2014 points out the six most important challenges for the road authority:

- Good accessibility and sound economic growth through a road network in harmony with its surroundings
- Safe and secure road traffic for everyone
- An energy-saving transport system with fuel-efficient and safe vehicles
- Vital urban areas in which to live, work and spend time
- A sound and viable transport industry
- An open and reliable road administration

ITS has been designated as a key tool for achieving the goals set for the new challenges. The strategic plan is based on the demands of the Swedish government as well as the users of the transport system.

The movement towards a network operator also shows that it is important for the SRA to work with a diversity of stakeholders in the public and private sectors. Appropriate partnering arrangements will be required to recognise their different aims, ambitions and motivations. ITS services may be appropriate for Public Private Partnerships (PPP) and alternative financing. It is, however, important to carefully consider how and where to involve the private sector. PPP solutions have been introduced by the SRA for the implementation of ISA, the national road database, the establishment of traffic management centres and information services and for the IVSS (Intelligent Vehicle Safety Systems) national research programme.

5. LESSONS LEARNED IN SWEDEN

At a national level, the SRA has set up road traffic management centres and systems together with other public authorities and private players and launched various traffic information services. These services primarily target the public. Within public transport there are also ITS applications targeting citizens, drivers and transport management. The transport industry has come relatively far in ITS applications that support the flow of goods for drivers and transport planners. There is also a growing number of service providers that are developing services aimed at both private individuals and the business community; e.g., travel planning, goods tracking, and support for optimising fuel consumption. Despite efforts to increase its use, ITS is generally still applied on a modest scale.

The socio-economic value offered by ITS in the long term is considerable. National and international evaluations show that ITS is still associated with costs that are too high at an individual level in relation to the level of benefit experienced. The same evaluations also show significant beneficial effects to society compared with traditional measures in the transport sector.

A prerequisite for ITS to become a complementary and accepted tool in road management is that the entire SRA adopts the intentions in the four stage principle. According to this, several measures are tested, including various types of ITS solutions, before a decision is made to invest in construction.

The tendency to date has been that the volume of work assigned to the SRA has grown without an increase in public funding. This has required greater internal efficiency, at the same time as there is an increasing demand for customer benefits. Focusing on the correct initiatives is even more important over the next few years if ITS is to offer an attractive and cost-efficient complement to traditional measures. The SRA must minimise double investments, reduce the number of heterogenic systems, reduce operating costs, and ensure the creation of interfaces towards other national players.

Based on the current situation, client requirements, and citizen and business needs, the following critical success factors have crystallised as being the most important for the SRA within the field of ITS over the next few years:

- Greater knowledge among leading players
- Developed decision-making data about socio-economic benefits
- Clearer incentives for broad use and the development of services
- Better quality in digital infrastructure and services
- Greater cost efficiency
- Clarification of the role and responsibility of the SRA

6. INTRODUCING A NATIONAL ITS STRATEGY

A national ITS strategy was launched in Sweden in August 2005.

The aim of this strategy is to provide the basis for a common approach in the ITS sector as well as to clarify the aims of the SRA in the field of ITS. The main focus areas proposed have used a holistic approach based on the SRA's customer-oriented programme, strategic plans and the international and national lessons learnt for the successful introduction of ITS. The focus is concentrated on five designated main areas for future efforts.

1. Better road safety
2. More efficient commuting
3. Support for more efficient commercial transports
4. Quality-assured road data and traffic information
5. Efficiency and reliability in the work on ITS

In brief, this concerns the following so that ITS can make a better contribution to the sub-goals in transport policy along with customer needs:

- In the field of road safety it is a question of compliance with speed regulations, a reduction in the number of drunk drivers and drivers with impaired driving ability and faster reaction times when accidents occur.
- For work-related commuting, initiatives are needed to improve road traffic management and to support public transport and drivers. Key measures are to shorten travel times, reduce congestion, and improve traffic information both before and during a journey.
- For a more efficient transport industry there is a need to define the commercial road network to create the preconditions for multimodal transports and to improve traffic information, both before and during a journey.
- Quality-assured road data and traffic information means that the SRA focuses on improving its role as a data and information provider to the outside world. Information about such things as disruptions, road works, road conditions and travel times as well as the National Road Database (NVDB) must be improved.
- In order for the SRA to be efficient and reliable in the field of ITS, measures are required that support internal cost efficiency, and international and national collaboration with other parties. The SRA must also stimulate the market to develop services, and to use evaluations to demonstrate socio-economic benefits.

7. EXAMPLES OF NETWORK OPERATIONS IN PRACTICE

More focus on customer-oriented service development

It is the ambition at the SRA to contribute to a broad use of qualitative ITS services that help achieve the goals in transport policy. As a means to this end, it is important to have many stakeholders acting on a sound suppliers market. The SRA has an important role through collaboration with various players to stimulate and provide the conditions for new services. It is also its role to provide different service developers with qualitative basic road data and traffic information.

SRA has recently organised a new development department that continually collects input from customers on how they want to use the transport system, and tries to develop new services to meet the mobility needs of individuals in society. For example, the SRA is

creating new services based on ITS to manage real-time travel information in metropolitan areas and services for commuters and commercial transport.

A growing number of people need to commute to work by train, bus and car. The trend is that distances between home and work are becoming longer. A reduction in travel time and disruptions during the journey are important for comfortable and efficient commuting. The direction taken by the SRA to date has been to collaborate with other parties to develop and establish road traffic management services on designated road networks in the Göteborg, Malmö and Stockholm regions to facilitate commuting and improve accessibility. The SRA is mainly interested in prioritising road traffic management services that create more efficient and easier commuting on designated commuting routes in both metropolitan areas and in other major labour market regions in the country. The aim to facilitate accessibility to public transport for disabled persons is included as part of this focus area. The services available on the Internet can be found at www.lagetpavagarna.se and www.trafiken.nu.



The amount of goods and bus transports on the road network is gradually increasing every year. At the same time, the transport sector is struggling with low profitability and poor compliance with competition regulations. Commercial traffic has therefore called for measures to make transports both more efficient and sustainable. The SRA focus is to provide more efficient road traffic management and better traffic information on designated commercial road networks.

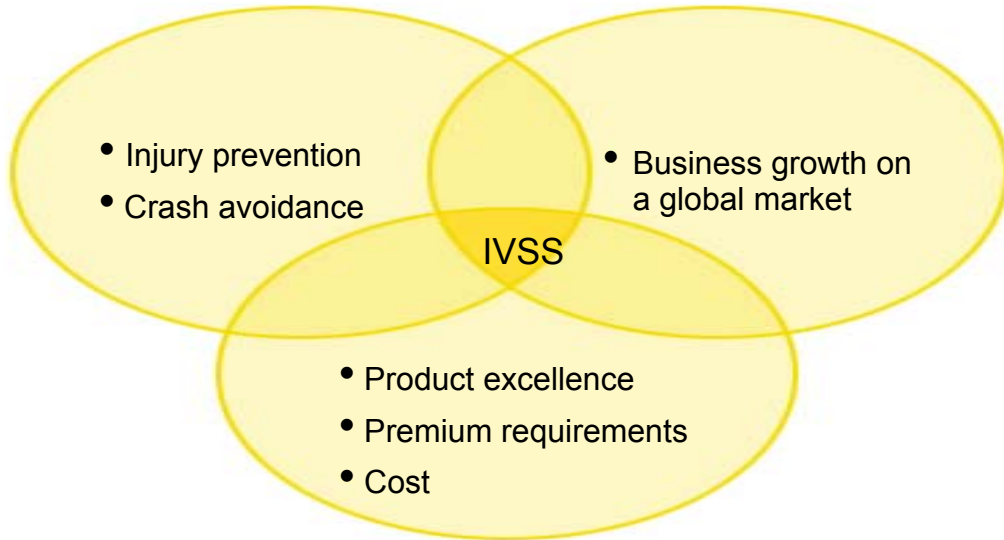
Collaboration for better in-vehicle safety systems

Greater compliance with rules and regulations has a significant potential to reduce the number of deaths and serious injuries in road traffic. According to SRA assessments, new technology in the form of ITS solutions can make a considerable contribution if these are used to a much greater extent than today. Through its ongoing endeavours, the SRA will mainly prioritise commercial traffic and organised passenger transport, as these categories are judged to have the best prerequisites to relatively quickly increase compliance with rules and regulations through a greater use of new supportive technology.

To speed up the process of development and implementation of in-vehicle safety solutions, the Swedish government approved a joint R&D programme between the automotive industry and the principal R&D financing authorities in Sweden to develop and

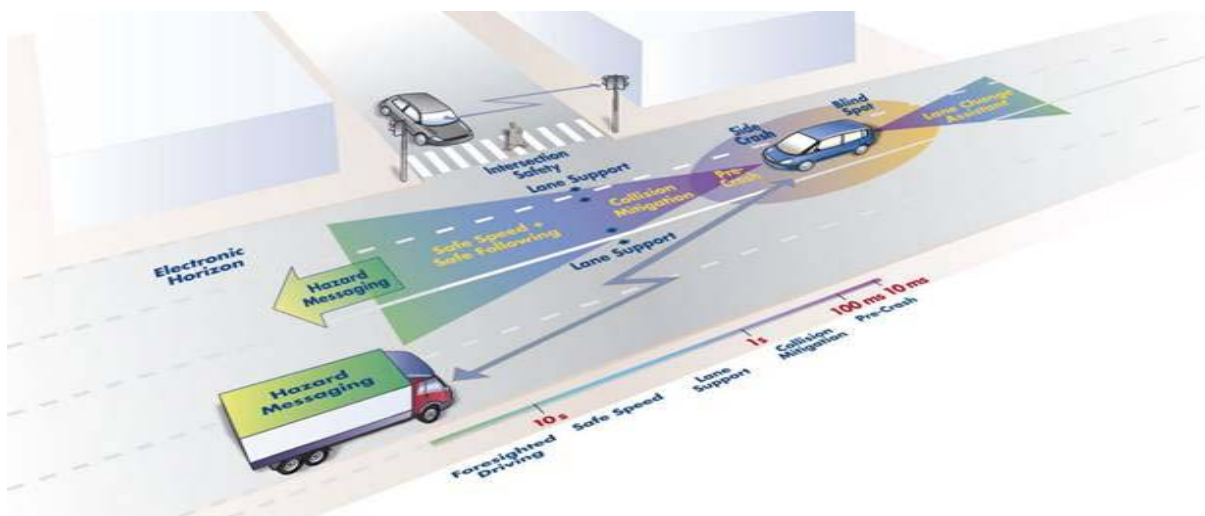
demonstrate such systems. This joint IVSS programme was launched in early 2004 and has been successful so far. It combines the different objectives of the various stakeholders and creates a good basis for the development of safety-related services of mutual interest.

Another political initiative is to develop Test Site Sweden as a field test and demonstration area for new jointly developed services that use both in-vehicle systems as well as systems that communicate with intelligent infrastructure.



Co-operative systems

The development towards co-operative systems is also part of the new environment in which national road authorities operate. Particularly important for the SRA are the infrastructure-related systems that will allow communication between vehicle and roadside systems. The concept of intelligent infrastructure will be changing with the integration of in-vehicle technologies and systems that can interact with already existing roadside infrastructure. SRA will consider using in-vehicle systems to complement its own systems and methods. Such systems might also provide major savings on investments in road infrastructure (including ITS) and maintenance. The future of co-operative systems should offer the opportunity to develop new services which enhance the value of already existing services, such as traffic monitoring.



Systematic collaboration towards better transport quality

Many companies, authorities and organisations can contribute towards more sustainable goods transport. OLA is a working approach in which system designers co-operate to try to find solutions to a common problem. Using facts available, potential solutions for one or more problems are discussed. With this approach, all parties are offered an opportunity to present desired measures they are able to implement, and as a result contribute to better transport quality. This working method is used at both the national and regional/local level. OLA is a Swedish acronym for Objective data, List of solutions and Addressed action plans.

This method has been used successfully to implement various types of ITS solutions such as ISA (Intelligent Speed Adaptation) and alcohol ignition interlocks. One result is that goods transport operators will install such systems in their vehicle fleets.

Use of pricing to steer road traffic

Traffic economists have claimed for many years that the use of road tolls is an efficient way to achieve a better use of resources on road networks in larger cities. There are few practical examples to refer to, in part because of the low political acceptance for this type of measure. The introduction of congestion charges in London in 2003 has, however, changed the situation.

On June 2, 2003, the Stockholm City Council passed a decision to conduct a trial implementation of environmental charges in the Stockholm inner city area. This culminated in the Congestion Tax Act being ratified by the Swedish Parliament on June 16, 2004.

The planning was fraught with difficulties, mainly legal problems, which resulted in a much shorter trial operation period than originally planned. The full-scale trial began on August 22, 2005 when Stockholm Transport extended its public transport services. On January 3, 2006 the congestion tax system was put into operation and was run until the end of July 2006. Much was learned in connection with this full-scale trial, not least of which was related to the part played by the SRA.

Evaluations from various perspectives were conducted continuously during the course of the trial operation. A 20-25% reduction in traffic within the city was found and the operational reliability of the system proved to be very high, with negligible shut-down time.

A referendum on the permanent implementation of the congestion tax was held in conjunction with the Swedish general election on September 17, 2006. The government declaration on October 6, 2006 stated that: "the Government will promote new models for the financing of infrastructure. A commissioner will be appointed for the Stockholm region".

The basic idea as regards moving towards a robust goods transport network is the importance of heavy duty vehicle routes being designed so as to avoid long-distance transports through city centres and built-up areas to the greatest possible extent.

The long-term focus is to achieve a fairer taxation of heavy goods transport combined with steering such transport towards a designated trunk road network. A differentiated kilometre tax system for heavy goods vehicles is an important and effective measure for achieving this goal.